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THE INFLUENCE OF THE HENS' HOUSING SYSTEM ON SOME PHYSICOCHEMICAL CHARACTERISTICS OF EGGS

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Abstract: Eggs are an important source of protein and nutrients for humans. Consumed rationally, they constitute a real stimulant of metabolic functions in the body, contributing to increasing resistance to disease and strengthening the nervous system. The quality of eggs concerns the nutritional factor, the microbiological one but also the toxic one, as it is known that the bioaccumulation of metals with toxic potential represents an extremely high risk for the health of consumers. The aim of this work was to measure the influence of hens' housing systems on the egg mass, on the weight and the content of minerals and metals of their shells and of the internal components of eggs. The eggs used in the study came from commerce and were produced in Romania. They were collected from two hens' housing systems, in improved batteries and in an ecological system. The weight of the whole eggs and the weight of the egg components were not significantly influenced by the housing system of the laying hens. The levels of the elements Fe, Zn, Se, Cu, Mn, Ni assayed in the samples of eggs collected from the improved batterie housing system were higher than in the samples from the ecological system. Of all the heavy metals with high toxicity, only Cd and Hg were detected in insignificant quantities in the shells, Hg in very low concentrations in the internal components of the analysed eggs.

• Introduction

The egg is an animal-based product with exceptional nutritional value, providing complete and balanced nutrition. It is rich in high-quality proteins, vitamins (such as A, D, E, B12, and riboflavin), minerals (including iron, phosphorus, and selenium), as well as antioxidants that support eye health. Essential fatty acids, such as omega-3, present in eggs, support cardiovascular health and brain function. People have used chicken eggs as a food source since ancient times due to their nutritional value and versatility. The egg is not only a valuable food item but also an essential raw material for various industries, including the food, textile, leather, and pharmaceutical industries, as well as for biotechnologies. The purpose of this study was to determine the influence/effect of chicken rearing systems on egg mass, the proportion and mineral content of the shells, and the internal components of the eggs.

• Material and method

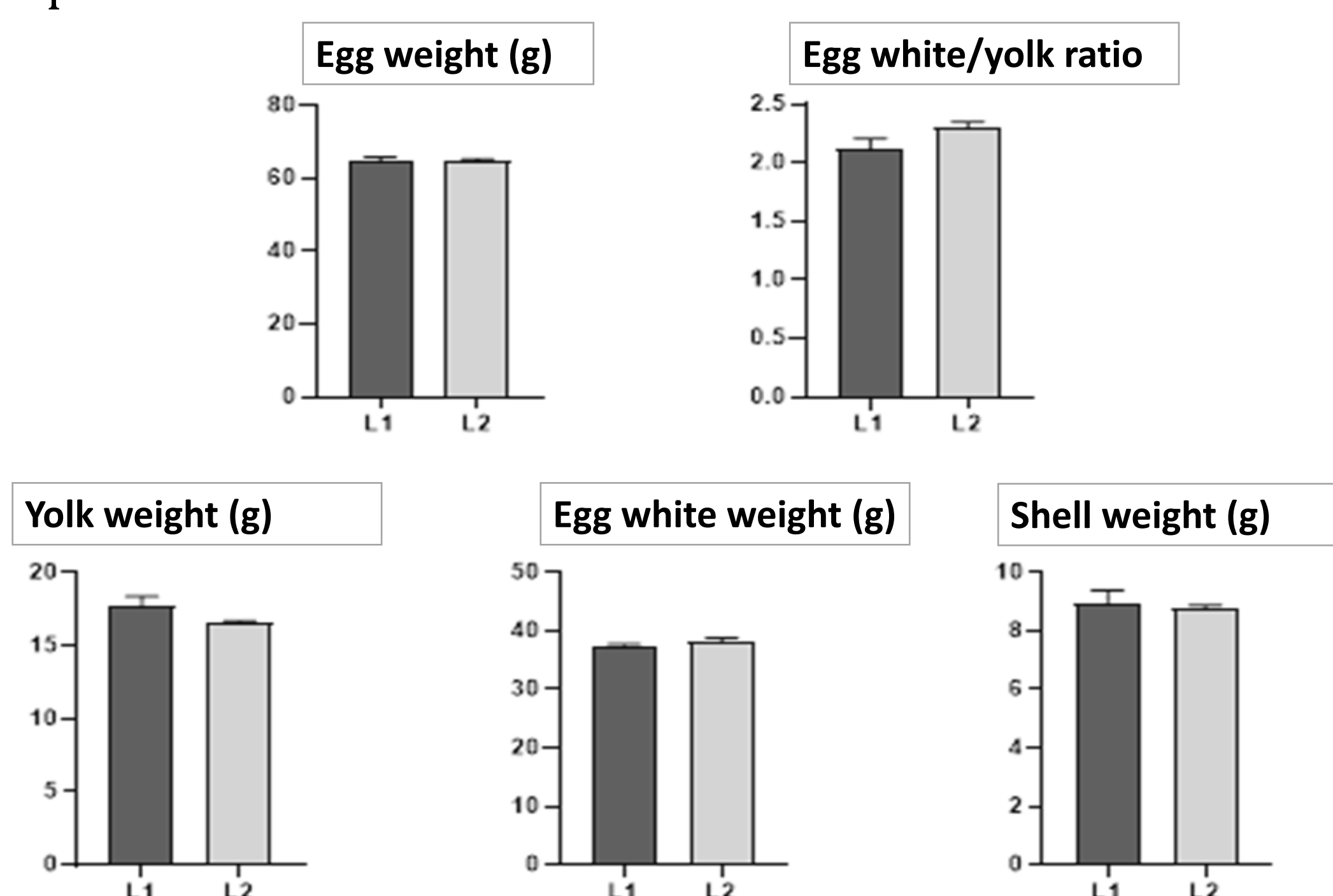
The following determinations were made:

-Determination of egg weight and its components: The total weight of the eggs was measured. The egg components—shell, egg white, and yolk—were separated and weighed.

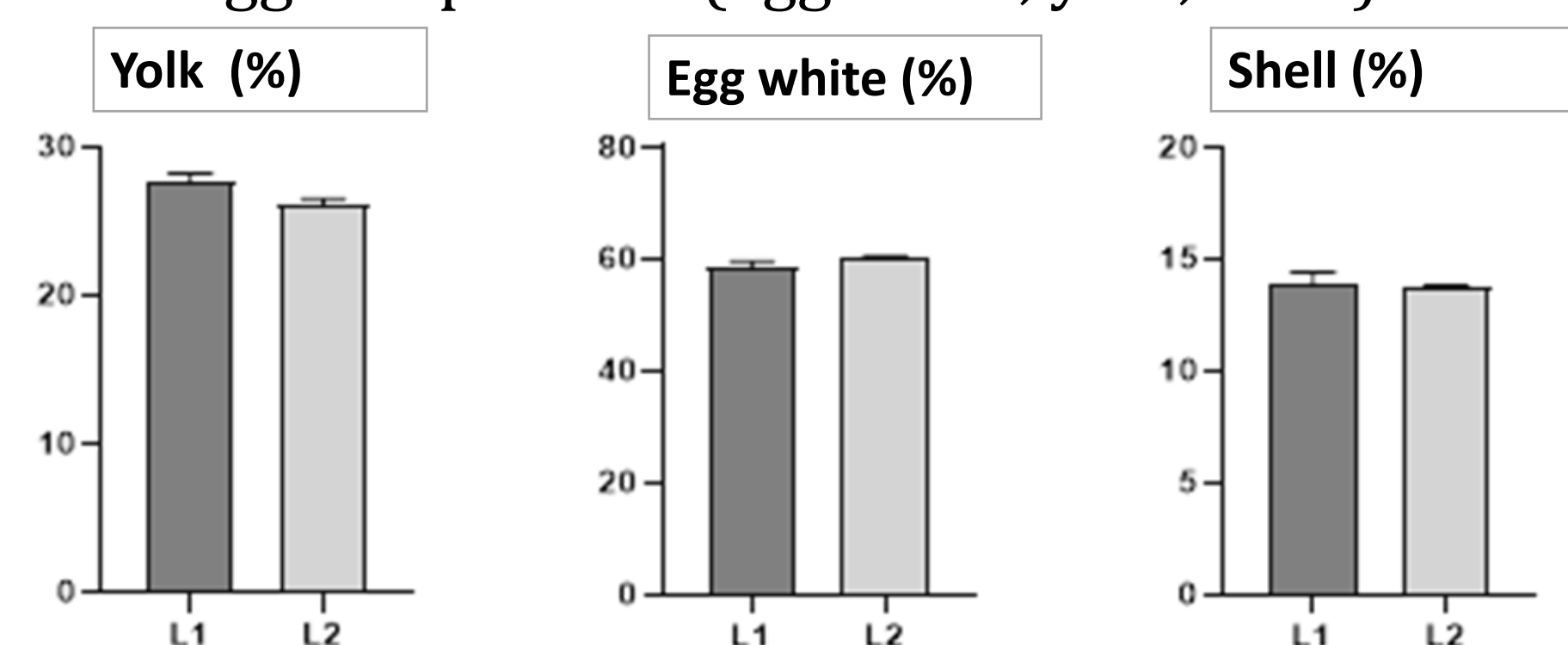
-Determination of metal content: For the analysis of metal and mineral content in the egg samples, the egg components were lyophilized until a constant weight was reached. All obtained values were recorded and statistically processed using GraphPad Prism 8.0 software.

• Results and discussions

Determination of the total weight of the eggs and their components:



Proportion of egg components (egg white, yolk, shell):



Comparative study of the metal content in the shells and internal components of the analyzed eggs:

Shell	Egg white	Yolk
L1: Ca > K > Fe > Mn > Zn > Se L2: Ca > K > Fe > Mn > Zn > Se [Ca] _{L1} < [Ca] _{L2} [K] _{L1} > [K] _{L2} [Fe] _{L1} < [Fe] _{L2} [Mn] _{L1} > [Mn] _{L2} [Zn] _{L1} < [Zn] _{L2} [Se] _{L1} < [Se] _{L2}	L1: K > Ca L2: K > Ca [K] _{L1} > [K] _{L2} [Ca] _{L1} > [Ca] _{L2}	L1: Ca > K > Fe > Zn > Cu L2: Ca > K > Fe > Zn > Cu [Ca] _{L1} > [Ca] _{L2} [K] _{L1} < [K] _{L2} [Fe] _{L1} > [Fe] _{L2} [Zn] _{L1} > [Zn] _{L2} [Cu] _{L1} > [Cu] _{L2}
L1: Cd > Hg L2: Cd > Hg [Cd] _{L1} < [Cd] _{L2} [Hg] _{L1} = [Hg] _{L2}	L1: Hg > Pb L2: Hg [Hg] _{L1} = [Hg] _{L2}	L1: Hg L2: Hg [Hg] _{L1} < [Hg] _{L2}

• Conclusions

Egg weight was not significantly influenced by the rearing system. The rearing system also did not significantly affect the proportion of egg components (egg white, yolk, shell). Eggs contain a large number of metals and minerals. Calcium is the major component of eggshells, but it is also present in the yolk and egg white of the tested eggs. In samples from the enriched-cage rearing system, levels of key elements such as Fe, Zn, Se, Cu, Mn, and Ni are higher than in samples from the organic system. The tested yolk samples contain more K, Ca, Zn, and Cu than the egg white samples. Of the toxic heavy metals, only Cd and Hg were detected in the shells, with Hg in small concentrations in the internal components of the analyzed eggs.